CLAIMS

1. Automatic precision drawing-off device with rinsing of the pipette, this device comprising at least two pumping units of different capacity, each comprising a cylindrical cavity (AL_1, AL_2) inside which a rod/piston unit (TP_1, TP_2) slides with imperviousness, said unit delimiting with said cavity a working chamber whose volume varies according to the axial position of the rod/piston unit (TP_1, TP_2), the extremities of the two rod/piston units (TP_1, TP_2) which come out of the two cavities being coupled to an activation member driven in rotation by a common motorisation (MO and MP), the working chamber of each of the pumping units (1, 2) being connected to a circuit successively comprising a pipe opening into a rinsing liquid reserve (RL), two successive electrovalves (EV_1, EV_2) and a circuit portion connecting the second electrovalve (EV_2) to drawing-off means (AP), the largest working chamber being connected into the circuit portion providing the link between the two electrovalves (EV_1, EV_2) whereas the second working chamber is connected to said circuit portion by means of a connector, characterised in that this circuit portion comprises an electrovalve (EV_3) situated between said connector and said drawing-off means, said electrovalves and said motorisation being controlled by control means designed so as to obtain a drawing-off cycle comprising at least one suction sequence in which the motor rotates continuously in a negative direction so as to provoke a sucking up of the rinsing liquid in the two chambers, this sequence comprising at least the following successive phases :

- a transitory phase in which the first valve (EV_1) is in an open position,
- a phase for taking a sample in which the second valve (EV_2) is closed and the third valve (EV_3) is open,
- an end of sample taking phase comprising the closing of the third valve (EV_3).

2. Device according to claim 1, characterised in that, during the said drawing-off cycle at the time of said transitory phase, the first two valves (EV_1, EV_2) are open whereas the third valve (EV_3) is in a closed position and at the time of said end of sample taking phase, the third valve (EV_3) is closed and the second valve (EV_2) is open.

3. Device according to claim 2, characterised in that the said drawing-off cycle comprises a flowing back sequence in which the motor rotates in a positive direction so as to provoke a flowing back of the rinsing liquid in the two chambers, this sequence comprising the following successive phases :

- a transitory phase in which the third valve (EV_3) is closed whereas the first two valves (EV_1, EV_2) are open so as to allow a flowing back of the rinsing liquid contained in the chambers towards the receptacle (RL),
- a flowing back phase in which the third valve (EV_3) is open whereas the second valve (EV_2) is closed, the first valve (EV_1) remaining open so as to enable the product to flow back into the analysis receptacle,
- an end of flow back phase comprising the closing of the third valve (EV_3) and the opening of the second valve (EV_2), the valve (EV_1) remaining open.

4. Device according to claim 3, characterised in that said drawing-off cycle comprises a rinsing phase during which the first valve (EV_1) is closed whereas the second and third valves (EV_2, EV_3) are open, the motor (MP) being activated step by step so as to push back the rinsing liquid contained in the two syringes in the direction of the drawing-off means.

5. Device according to claim 4, characterised in the said drawing-off cycle comprises a return to zero phase comprising the filling of the chambers with the rinsing liquid, the first two valves (EV_1, EV_2) being open whereas the third valve (EV_3) is closed, the motor rotating in a negative direction so as to bring back the pistons below the "zero" position, followed

by a phase for evacuating air from the drawing-off means by opening the second and third valves (EV_2, EV_3) and by closing the first valve (EV_1), the motor rotating in a positive direction so as to provoke a flowing back of the rinsing liquid towards the drawing-off means (AP) and to bring back the pistons (TP_1, TP_2) into an idle position, the third electrovalve (EV_3) then being closed whereas the first electrovalves (EV_1, EV_2) are open.

6. Device according to claim 1, characterised in that, during said drawing-off cycle, at the time of the said transitory phase, the second and third valves (EV_1, EV_3) are open and the second valve (EV_2) is closed, and at the time of said end of sample taking phase, the valve EV_3 is closed and the motor starts an inversion of direction of rotation transitory phase.

7. Device according to claim 6, characterised in that said drawing-off cycle comprises a flowing back sequence with first a flowing back of the rinsing liquid into the two chambers, and secondly a flowing back of the sample into the analysis receptacle, this sequence comprising the following successive phases :

- a phase where the first and second valves (EV_1, EV_2) are open and the third valve (EV_3) is closed to allow a flowing back of the rinsing liquid contained in the chambers towards the receptacle (RL),
- a transitory play adjustment phase in which the second valve (EV_2) is closed, the first valve (EV_1) remaining open and the third valve closed,
- a phase in which the third valve (EV_3) is open whereas the first valve (EV_1) stays open and the second valve (EV_2) is closed to enable the product to flow back into the analysis receptacle (RA),
- a phase for controlling the zero position of the motor.

8. Device according to claim 7, characterised in that the said drawing-off cycle comprises a rinsing sequence during which the liquid contained in the pipette is pushed back into the rinsing well, the second and third valves (EV_2, EV_3) being open whereas the first valve (EV_1) is closed,

the motor being activated step by step so as to obtain a flowing back in several stages.

9. Device according to claim 8, characterised in that the said drawing-off cycle comprises a phase for return to an initial state comprising :

- the filling of the chambers with the rinsing liquid, the first and second valves (EV_1, EV_2) being open and the third valve (EV_3) closed, the motor rotating in a negative direction as far as a position slightly below the zero level,
- a zero control phase during which the motor is driven in rotation in a positive direction until the zero position is detected,
- a play adjustment phase in which the first valve (EV_1) is closed again and the motor is driven in rotation in a negative direction until it comes back to a position situated slightly below the zero level.
- a final phase for return to an initial state in which the first and third valves (EV_1, EV_3) are open whereas the second valve (EV_2) is closed, the motor being at a dead stop.

10. Device according to one of the preceding claims, characterised in that the cylindrical cavities (AL_1, AL_2) of the two pumping units (1, 2) are embodied in a given material block (B).

11. Device according to one of the preceding claims, characterised in that the said motorisation comprises a motor (MP) driving a pinion (PN) which gears with a rack (CR) integral with said activation member.

12. Device according to one of the preceding claims, characterised in that the upper extremities of the cylindrical cavities (AL_1, AL_2) and the rod/piston assemblies (TP_1, TP_2) are conical.

13. Device according to claim 12, characterised in that the conical shape (PC_1) of the smallest cylindrical cavity (AL_1) communicates directly with the pipe connected to the drawing-off means (AP).

14. Device according to claim 1, characterised in that the said pumping units consist of modules (M_1 to M_4) each comprising a body having two parallel assembling faces (FA_1, FA_2) into which a traversing pipe (CT) opens in communication with said cylindrical cavity (CC_1, CC_2) and having one portion able to be sealed off by an electrovalve (EV'_1), the orifices of said pipe being equipped with connection means making it possible to provide a sealed connection with a corresponding orifice of another module (M_1 to M_4) when the two modules are assembled to each other via their assembling faces and fixed in this position with the aid of fixing means (TR), said orifices being able to be moreover connected, either to the rinsing liquid intake pipe or to the pipe connected to the drawing-off means (AP).

15. Device according to claim 14, characterised in that each of the modules (M_1 to M_4) comprises a pipe (CP) in communication with the cylindrical cavity (CC_1) and which opens outside via an orifice constituting a parallel outlet (SP), said pipe (CC_1) being able to be sealed off by an electrovalve (EV'_2).

16. Device according to one of the preceding claims, characterised in that said electrovalves (EV_1, EV_2 - EV'_1, EV'_2) and said motorisation (MO and MP) are controlled by a processor (MC) receiving information relating to the position of the rod/piston assemblies (TP_1, TP_2 - TP'_1, TP'_2).

17. Device according to claim 16, characterised in that said information is obtained with the aid of an optical fork associated with said rack (CR).